

the group of n-paraffin compounds and mixtures thereof.

20. (Unchanged) The method of Claim 14 wherein the propellant selected by said method is a fuel or is an oxidant.

21. (Unchanged) The method of Claim 14 wherein the propellant is selected from the group of isomers of the alkane class of hydrocarbons.

48. (Unchanged) The method of Claim 14 used to select a propellant that will exhibit a regression rate tailored to a particular application or mission.

### **REMARKS**

This amendment is submitted in response to the Office Action dated July 28, 2000. A petition for a three month extension of time is enclosed along with the appropriate fee to extend the due date from October 28, 2000 to January 28, 2001.

The claims have been amended to correct certain informalities and to more particularly claim the invention. For example, claim 14 has been amended to provide proper antecedent basis and definition for certain of the terms. The definitions added can be found in the specification for example at pages 12 to 14. A mistake was made in the units for a <sup>onset</sup> and has been corrected. Support for this change can be found in the specification at page 33. Claim 15 has been cancelled.

The Examiner rejects claims 14-21 and 48 under 35 U.S.C 112, second paragraph, as being indefinite. Applicant respectfully submits that the claims as amended are now definite.

The Examiner rejects claims 14-21 and 48 under 35 U.S.C. as being directed to non-statutory subject matter. Applicant respectfully submits that the claimed invention is directed to statutory subject matter. *State Street Bank* established that the claimed invention as a whole must produce a "useful, concrete and tangible result." 149 F.3d 1368, 1373, 47 USPQ2d 1596, 1601-02. The claimed invention clearly recites method steps which produce a useful, concrete and tangible result; i.e. the identification of a propellant which satisfies the entrainment onset parameter, thus providing entrainment which improves the regression rate of the propellant. MPEP 2106(II)(A) states:

Office personnel have the burden to establish a *prima facie* case that the claimed

invention as a whole is directed to solely an abstract idea or to manipulation of abstract ideas or does not produce a useful result. Only when the claim is devoid of any limitation to a practical application in the technological arts should it be rejected under 35 U.S.C. 101.

Applicant respectfully submits that the claimed invention clearly provides statutory subject matter. The claimed invention provides a method of selecting a propellant based on physical parameters such as flux through a port, and on various physical properties of the propellant. This allows those skilled in rocket science to predict whether a given material will be suitable for use as a propellant. This is a significant advance in the state of the art, and can save the expenditure of large sums of money and effort in research of propellants.

The Examiner next rejects claims 14-21 and 48 under 35 U.S.C. 112, first paragraph, as being non-enabling. Applicant respectfully submits that the claimed invention is clearly enabled, and that an enabling disclosure is provided. The propellant selection method is clearly described in the specification, for example at pages 15 to 24. The entrainment onset parameter  $a_{onset}$  is clearly described for example at pages 21 to 24, and the values where entrainment will occur are shown on page 22. Applicant respectfully submits that those of skill in the art can calculate the entrainment onset parameter for materials of interest given the teaching of the present invention. Once that parameter is known, it is then compared with the values given in equation 18, page 22, to predict whether entrainment is likely to occur.

Reference is made in the specification to the Stanford University Thesis (reference 2). This reference is not necessary to enable the invention, but is provided in the event a reader wishes to refer to the mathematical and theoretical derivation of equations described in the specification. These mathematical and theoretical derivations are not necessary to practice the invention. The method steps, equations and principles necessary to practice the invention by those skilled in the art are fully described in the specification.

Moreover, many working examples are provided to provide further guidance and direction for practicing the invention. For example, Table 1 lists various propellants tested along with the rocket or engine parameters such as the initial port diameter, the port length, the oxidizer gas flow rate, the burn time, and the resultant regression rate. Further, relevant fuel variables for a number of propellants are shown in Table 2, and the entrainment onset parameters are shown. Those of skill

in the art can easily obtain the physical parameters of other materials as such parameters are widely published in known references or experimentally determined. Further, guidance and direction are provided in Figure 9, among others showing, the entrainment of the propellant as a function of the molecular weight. These are exemplary, and the Applicant respectfully submits that there is considerable teaching, guidance and direction in the specification and drawings on how to practice the claimed invention.

Applicant acknowledges that there are no prior art rejections in the instant Office Action.

Applicant has recently discovered additional prior art, a publication by D. Gramer, et al, entitled "*Experimental Investigation of a Metallized Cryogenic Hybrid Rocket Engine*" which is disclosed in a Supplemental Information Disclosure Statement filed simultaneously herewith. Gramer describes a metallized cryogenic hybrid rocket engine. The engine as shown in Figure 1 of Gramer uses a large cryogenic bath surrounding the fuel grain. Methane, kerosene and paraffin were tested as fuel grains and were typically metallized by adding aluminum powder. Gramer does not disclose or suggest a method of selecting a propellant that exhibits surface tension and viscosity values such that the entrainment onset parameter has a value that promotes entrainment into the gas stream as recited in Applicant's amended claims. While Gramer mentions the use of paraffin, no data is presented and no conclusions are drawn with respect to its efficacy or suitability as a fuel. Gramer provides no discussion or motivation for one to arrive at Applicant's invention which is directed to this selection of a fuel. Accordingly, Applicant respectfully submits that the present invention is patentable over the newly cited art.

Based on the foregoing, Applicant respectfully submits that the application is now in condition for allowance. If any matters can be resolved by telephone, the Examiner is invited to call the undersigned attorney at the telephone number listed below. The Commissioner is authorized to charge any additional fees to Deposit Account No. 06-1300 (Order No. A-67587-1/AJT/MSS).

Respectfully submitted,

  
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Maria S. Swiatek, Reg. No. 37,244

FLEHR HOHBACH TEST ALBRITTON & HERBERT LLP  
4 Embarcadero Center, Suite 3400  
San Francisco, CA 94111-4187  
Telephone: (650) 494-8700